Canadian Metallurgical Quarterly

Volume 37, 1998

List of Contents and Author Index

PERGAMON

Canadian Metallurgical Quarterly

A Publication of the Metallurgical Society of CIM

Editor

D. G. IVEY, *Department of Chemical and Materials Engineering, University of Alberta, 536 Chemical-Mineral Engineering Building, Edmonton, Alberta, Canada T6G 2G6. doug.ivey@ualberta.ca*

Associate Editors

H. HENEIN, M. L. WAYMAN, T. M. MACCAGNO, *Department of Chemical and Materials Engineering, University of Alberta, 536 Chemical-Mineral Engineering Building, Edmonton, Alberta, Canada T6G 2G6*

Editorial Advisory Board

L. AMARATUNGA, *Laurentian University, Sudbury, Ontario*
N. BIRKS, *University of Pittsburgh, Pittsburgh, PA*
W. F. CALEY, *Dalhousie University, Halifax, Nova Scotia*
M. J. FAIRWEATHER, *Cominco Research, Trail, B.C.*
C. FLEMING, *Lakefield Research, Lakefield, Ontario*
M. L. GAGNÉ, *Rio Tinto Iron & Titanium Inc. Tech. Group, Sorel, Quebec*
B. HARRIS, *Mining Industry Techn. Council of Can., Ottawa, Ontario*
R. HOLT, *NRC Aerospace Mat. Inst., Ottawa, Ontario*
G. IRONS, *McMaster University, Hamilton, Ontario*
D. J. LLOYD, *Alcan Research Laboratory, Kingston, Ontario*
J. LUO, *University of Alberta, Edmonton, Alberta*
S. MARCUSON, *INCO Ltd, Sudbury, Ontario*
A. MCLEAN, *University of Toronto, Toronto, Ontario*
V. G. PAPANGELAKIS, *University of Toronto, Toronto, Ontario*
A. D. PELTON, *Ecole Polytechnique, Montreal, Quebec*
M. RUSCOE, *Viridian Inc., Fort Saskatchewan, Alberta*
S. SANT, *California, USA*
R. THIBAU, *QIT-Fer et Titane Inc., Sorel, Quebec*
W. R. TYSON, *Canmet, Ottawa, Ontario*
G. VAN WEERT, *Oretome Ltd, Ontario*
M. WATT, *University of Windsor, Windsor, Ontario*
A. E. WRAITH, *University of Newcastle upon Tyne, U.K.*

The *Canadian Metallurgical Quarterly* is published by the Metallurgical Society of the Canadian Institute of Mining and Metallurgy as a contribution to the science and technology of metallurgy and materials science.

Published five times per year in January, April, July, October and December

© 1998 Canadian Institute of Mining and Metallurgy

Advertising information. Advertising orders and enquiries can be sent to: **Europe and ROW:** Rachel Gresle-Farthing, Elsevier Science Ltd, Advertising Department, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK; phone: (+44) (1865) 843565; fax: (+44) (1865) 843976; e-mail: r.gresle-farthing@elsevier.co.uk. **USA and Canada:** Elsevier Science Inc., Mr Tino DeCarlo, 655 Avenue of the Americas, New York, NY 10010-5107, USA; phone: (+1) (212) 633 3815; fax: (+1) (212) 633 3820; e-mail: t.decarlo@elsevier.com. **Japan:** Elsevier Science K.K., Advertising Department, 9-15 Higashi-Azabu 1-chome, Minato-ku, Tokyo 106, Japan; phone: (+81) (3) 5561 5033; fax: (+81) (3) 5561 5047.

Subscription Rates

Annual Institutional Subscription Rates 1998: Europe, The CIS and Japan 1008 Dutch Guilders. All other countries US$579. Members of the Canadian Institute of Mining and Metallurgy may order personal subscriptions at a concessional rate and details of these rates are available on request. Dutch Guilder prices exclude VAT. Non-VAT registered customers in the European Community will be charged the appropriate VAT in addition to the price listed. Prices include postage and insurance and are subject to change without notice.

Orders, claims, and product enquiries: please contact the Customer Support Department at the Regional Sales Office nearest you:

New York: Elsevier Science, PO Box 945, New York, NY 10159-0945, USA; phone: (+1) (212) 633 3730 [toll free number for North American customers: 1-888-4ES-INFO (437-4636)]; fax: (+1) (212) 633 3680; e-mail: usinfo-f@elsevier.com

Amsterdam: Elsevier Science, PO Box 211, 1000 AE Amsterdam, The Netherlands; phone: (+31) 20 4853757; fax: (+31) 20 4853432; e-mail: nlinfo-f@elsevier.nl

Tokyo: Elsevier Science K.K., 9-15 Higashi-Azabu 1-chome, Minato-ku, Tokyo 106, Japan; phone: (+81) (3) 5561 5033; fax: (+81) (3) 5561 5047; e-mail: info@elsevier.co.jp

Singapore: Elsevier Science, No. 1 Temasek Avenue, #17-01 Millenia Tower, Singapore 039192; phone: (+65) 434 3727; fax: (+65) 337 2230; e-mail: asiainfo@elsevier.com.sg

Rio de Janeiro: Elsevier Science, Rua Sete de Setembro 111/16 Andar, 20050-002 Centro, Rio de Janeiro - RJ, Brazil; phone: (+55) (21) 509 5340; fax: (+55) (21) 507 1991; e-mail: elsevier@campus.com.br [Note (Latin America): for orders, claims and help desk information, please contact the Regional Sales Office in New York as listed above]

Periodicals postage paid at Rahway, NJ and additional entry points. *Canadian Metallurgical Quarterly* (ISSN 0008-4433) is published five issues per year in January, April, July, October and December, by the Canadian Institute of Mining and Metallurgy, c/o Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. The annual subscription in the U.S.A. is $570. *Canadian Metallurgical Quarterly* is distributed by Mercury Airfreight International Ltd, 10 Camptown Road, Irvington, NJ 07111-1105. Postmaster: please send address changes to *Canadian Metallurgical Quarterly*, c/o Elsevier Science Regional Sales Office, Customer Support Department, 655 Avenue of the Americas, New York, NY 10010, U.S.A.

Back Issues

Back issues of all previously published volumes are available direct from Elsevier Science offices (Oxford, New York). Complete volumes and single issues can be purchased for 1990–1996. Earlier issues are available in high quality photo-duplicated copies as complete volumes only. Back volumes on microfilm are available from UMI, 300 North Zeeb Road, Ann Arbor, MI 48106, U.S.A.

Canadian Metallurgical Quarterly

Volume 37, No. 1, January 1998

CONTENTS

Review

G. P. Demopoulos — 1 — Aqueous processing and its role in the production of inorganic materials and environmental protection

MINERALS AND MINERAL PROCESSING

F. J. Tavera, C. O. Gomez and J. A. Finch — 19 — Conductivity flow cells for measurements on dispersions

CHEMICAL AND EXTRACTIVE METALLURGY

A. Warczok and T. A. Utigard — 27 — Fayalite slag reduction by solid graphite

E. Jak, S. Degterov, P. C. Hayes and A. D. Pelton — 41 — Thermodynamic optimisation of the systems CaO-Pb-O and PbO-CaO-SiO_2

K. Okumura, R. Harris and M. Sano — 49 — Bubble formation from nonwetted slot nozzles

MATERIALS PROPERTIES AND PROCESSING

J. M. Bastidas and E. M. Mora — 57 — A laboratory study of mild steel vapour phase corrosion and its inhibition by dicyclohexylamine nitrite

M. H. El-Naas, R. J. Munz and F. Ajersch — 67 — Modelling of a plasma reactor for the synthesis of calcium carbide

Canadian Metallurgical Quarterly

Volume 37, No. 2, April 1998

CONTENTS

Review

V. M. Khlestov, E. V. Konopleva and H. J. McQueen — 75 Kinetics of austenite transformation during thermo-mechanical processes

CHEMICAL AND EXTRACTIVE METALLURGY

G. Tekin, Y. Onganer and M. Alkan — 91 Dissolution kinetics of ulexite in ammonium chloride solution

J.-L. Liow, P. Tsirikis and N. B. Gray — 99 Study of refractory wear in the tuyere region of a Peirce-Smith nickel converter

PHYSICAL METALLURGY AND MATERIALS

R. Louahdi, E. H. Ouakdi, A. Boucenna, G. Saindrenan, R. Legall and F. Ferhat — 119 The effect of defect annihilation on the segregation kinetics of sulphur in both quenched and cold worked nickel

H. J. McQueen, M. Myshlyaev, E. Konopleva and P. Sakaris — 125 High temperature mechanical and microstructural behavior of A356/15 vol% SiCp and A356 alloy

S. P. Gupta — 141 Kinetics of discontinuous precipitation and dissolution in Cu-Ag alloys

MATERIALS PROPERTIES AND PROCESSING

N. Sen, R. Sau, S. Mazumdar, M. Ghosh, S. K. Sahay, A. K. Ray — 161 Physical modelling of liquid feeding for an unequal diameter two roll thin strip

Canadian Metallurgical Quarterly

Volume 37, No. 3–4, July–October 1998

CONTENTS

SPECIAL ISSUE: COMPUTATIONAL FLUID DYNAMICS AND HEAT/MASS TRANSFER MODELING (CFD AND HMTM) IN THE METALLURGICAL INDUSTRY

Guest Editor: S. A. Argyropoulos

	167	Foreword
V. R. Voller	169	A numerical scheme for solidification of an alloy
R. A. Stoehr	179	Modeling the influence of fluid flow on the development of porosity and microstructure in castings
M. Trovant and S. A. Argyropoulos	185	The implementation of a mathematical model to characterize mold metal interface effects in metal casting
X. Huang and B. G. Thomas	197	Modeling of transient flow phenomena in continuous casting of steel
S. H. Seyedein and M. Hasan	213	A 3-D numerical prediction of turbulent flow, heat transfer and solidification in a continuous slab caster for steel
D. M. Stefanescu and H. Pang	229	Modeling of casting solidification. Stochastic or deterministic?
R. P. Tavares and R. I. L. Guthrie	241	Computational fluid dynamics applied to twin-roll casting
M. Salcudean	251	Modelling of industrial processes using computational fluid dynamics
Y. Y. Sheng and G. A. Irons	265	Mathematical and physical modelling of fluid flow and heat transfer in electric smelting
T. Ahokainen and A. Jokilaakso	275	Numerical simulation of the Outokumpu flash smelting furnace reaction shaft
T. Takasu, H. Itou, T. Nakamura and J. M. Toguri	285	Observation and calculation of Marangoni convection induced thermally in a molten salt
K. Hong, D. C. Weckman and A. B. Strong	293	The influence of thermofluids phenomena in gas tungsten arc welds in high and low thermal conductivity metals
M. R. Aboutalebi and J. V. Khaki	305	Heat transfer modelling of the melting of solid particles in an agitated molten metal bath
N. A. Berjeza and N. I. Misuchenko	313	Computational modelling of heat/mass transfer near the liquid–solid interface during rapid solidification of binary metal alloys under laser treatment
P. Jain, L. I. Kiss, A. Charette, R. T. Bui, T. Bourgeois and W. Stevens	323	The effect of burner orientation on the convective heat transfer rate in a round furnace
C. Bazin, D. Hodouin, C. Duchesne, J. Thibault and A. R. Trusiak	333	Reconciliation of mass and energy data measurements: Application to a rotary dryer

Canadian Metallurgical Quarterly

Volume 37, No. 5, December 1998

CONTENTS

Review

C. Labrecque and M. Gagné — 343 Ductile iron: fifty years of continuous development

C. J. Menéndez, E. J. Nolasco, E. L. Tavani and E. Pereira — 379 Chlorination of a scheelite-wolframite concentrate with chlorine and sulphur dioxide

R. K. Paramguru and S. B. Kanungo — 389 Electrochemical phenomena in MnO_2–FeS_2 leaching in dilute HCl. Part 1: Theoretical derivation of rate equations under various limiting conditions

R. K. Paramguru, K. G. Mishra and S. B. Kanungo — 395 Electrochemical phenomena in MnO_2–FeS_2 leaching in dilute HCl. Part 2: Studies on polarization measurements

R. K. Paramguru and S. B. Kanungo — 405 Electrochemical phenomena in MnO_2–FeS_2 leaching in dilute HCl. Part 3: Manganese dissolution from Indian ocean nodules

M. A. Youssef and M. B. Morsi — 419 Reduction roast and magnetic separation of oxidized iron ores for the production of blast furnace feed

P. Perdikis and V. G. Papangelakis — 429 Scale formation in a batch reactor under pressure acid leaching of a limonitic laterite

R. C. Nascimento, M. B. Mourão and J. D. T. Capocchi — 441 Reduction-swelling behaviour of pellets bearing iron ore and charcoal

M. Richert, H. J. McQueen and J. Richert — 449 Microband formation in cyclic extrusion compression of aluminum

A. Bahadur — 459 Development and evaluation of a low chromate corrosion inhibitor for cooling water systems

469 Book review